

MAR - 1989 EM-4180110-174

ROCKY FLATS PLANT

1E687



000020541

MONTHLY ENVIRONMENTAL MONITORING REPORT

ENVIRONMENTAL MANAGEMENT:

F. D. HOBBS, MANAGER
N. M. DAUGHERTY, HEALTH PHYSICIST
L. A. MOONEY, REPORT COORDINATOR

CONTRIBUTORS:

M. R. BOSS
A. M. LONG
C. L. SUNDBLAD
HS&E LABORATORIES
GENERAL LABORATORIES



Rockwell International

Aerospace Operations
Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

A Prime Contractor to
The United States Department of Energy

DOCUMENT CLASSIFICATION
REVIEW WAIVER PER
CLASSIFICATION OFFICE

ADMIN RECORD

Distribution

USDOE

Albuquerque Operations Office
Health Protection Branch
P O Box 5400
Albuquerque, NM 87115

C L Soden

USDOE

Rocky Flats Plant

A E Whiteman

USEPA

Ore Derver Place - Suite 1300
999 - 18th Street
Denver, CO 80202-2413

Dr M Lammering

Colorado Dept of Health
4210 E Eleventh Avenue
Denver, CO 80220

D Holme A. J. Hazle
P Frohardt R Quillin

Division of Environmental Health
Boulder City/County Health Dept.
2450 Broadway
Boulder, CO 80302

T Douville

City of Arvada
Utilities Division
8101 Ralston Road
Arvada, CO 80002

S Daniels

Colorado Water Conservation Board
823 State Centennial Building
1313 Sherman Street
Denver, CO 80203

N C. Ioannides

Jefferson County Health Dept.
260 South Kipling
Lakewood, CO 80226

Dr C Miller

City of Broomfield
#6 Garden Office Center
Broomfield, CO 80020

K. Schnoor

Office of City Manager
City of Boulder
P. O. Box 791
Boulder, CO 80302

J. Piper A. Struthers

City of Northglenn
11701 Community Center Drive
Northglenn, CO 80234

T Ambalam

City of Westminster
4800 W. 92nd Avenue
Westminster, CO 80030

W. Christopher

City of Fort Collins
Office of the City Manager
300 La Porte
Fort Collins, CO 80525

S. Burkett

Denver Water Department
Quality Control
1600 W. 12th Avenue
Denver, CO 80254

J. Dice

Air Pollution Control Spec.
c/o Colorado Dept. of Health
4210 E. Eleventh Avenue
Denver, CO 80220

H. Collier

Peak Rock Spring Water
3090 - 17th Street
Boulder, CO 80304

S. Dolson

L. C. Holdings
11728 Hwy. 93
Boulder, CO 80303

Martin Jones

Distribution

Rocky Flats Plant

M R Boss
L E Coldren
R J Erfurdt
P J Etchart
K J Freiberg
T C Greengard
F D Hobbs
C R Hodgkin
D S Hurtt
R A Link
A M Long
C M Marsh
K B McKinley
E R Naimon
G L Potter
R Roberts
D J Sanchini
G H Setlock
C L Sundblad
C Tricet
W F Weston
J J Whicker
EMF
IRF-Library

MARCH 1989 ENVIRONMENTAL MONITORING REPORT
ROCKY FLATS PLANT

This report summarizes the effluent and environmental monitoring programs at the Rocky Flats Plant for the month of March 1989

Included in the report are monitoring results for radioactive and nonradioactive airborne effluents continuously sampled from Plant buildings, Tables I and II. Tables III through V summarize environmental monitoring data from the Rocky Flats Plant ambient air sampling network. This network is comprised of continuously operating air samplers located on plantsite, around the Plant boundary, and in neighboring communities.

Water sampling results for radioactive constituents are given in Tables VI through VIII. Results are summarized for Plant surface water control ponds, for nearby drinking water reservoirs, and for tap water for neighboring communities. Nitrate monitoring for Great Western Reservoir and Standley Lake, the two drinking water reservoirs which can receive surface water discharges from the Plant, are summarized in Table IX.

The Environmental Protection Agency (EPA) has issued to the Plant a National Pollutant Discharge Elimination System (NPDES) permit for control of surface water discharges. Water sampling results associated with the NPDES permit, as well as applicable discharge limitations imposed by that permit, are reported in Table X. Analytical results for nonradioactive parameters in water at the Walnut Creek at Indiana Street location are summarized in Table XI. Daily flow data for surface water from the two Plant drainage systems are given in Tables XI, XII, and XIII.

The Rocky Flats Plant Environmental Monitoring Program includes evaluating plant compliance with all relevant guides, limits, and standards. All average results of monitoring effluent and ambient samples complied with the applicable standards as specified in Executive Order 12088 (rules, regulations, and requirements of the Department of Energy).

The data provided in this report are provided as a matter of comity and should not be construed as an application for a permit or license, or in support of such an application. Approval of the Department of Energy should be obtained prior to publication of any data contained within this report.

Table I 1989 Plutonium and Uranium Airborne Effluent Data

Month	Plutonium		Uranium	
	(01/19/89 - 02/20/89 - Feb)		(01/20/89 - 02/21/89 - Feb)	
	Release (uCi)	CMax (pCi/m3)	Release (uCi)	CMax (pCi/m3)
CY 1988	15 33	0 023 ± 0 0052	11 93	0 009 ± 0 0009
January	0 33	0 005 ± 0 0005	0 15	0 000 ± 0 0001
February	0 15	0 001 ± 0 0001	0 20	0 001 ± 0 0002
March	0 07*	0 001 ± 0 0001	0 04	0 002 ± 0 0002
April				
May				
June				
July				
August				
September				
October				
November				
December				
Year to Date	0 55*	0 005 ± 0 0005*	0.39	0 001 ± 0 0002

* 2 incomplete analyses

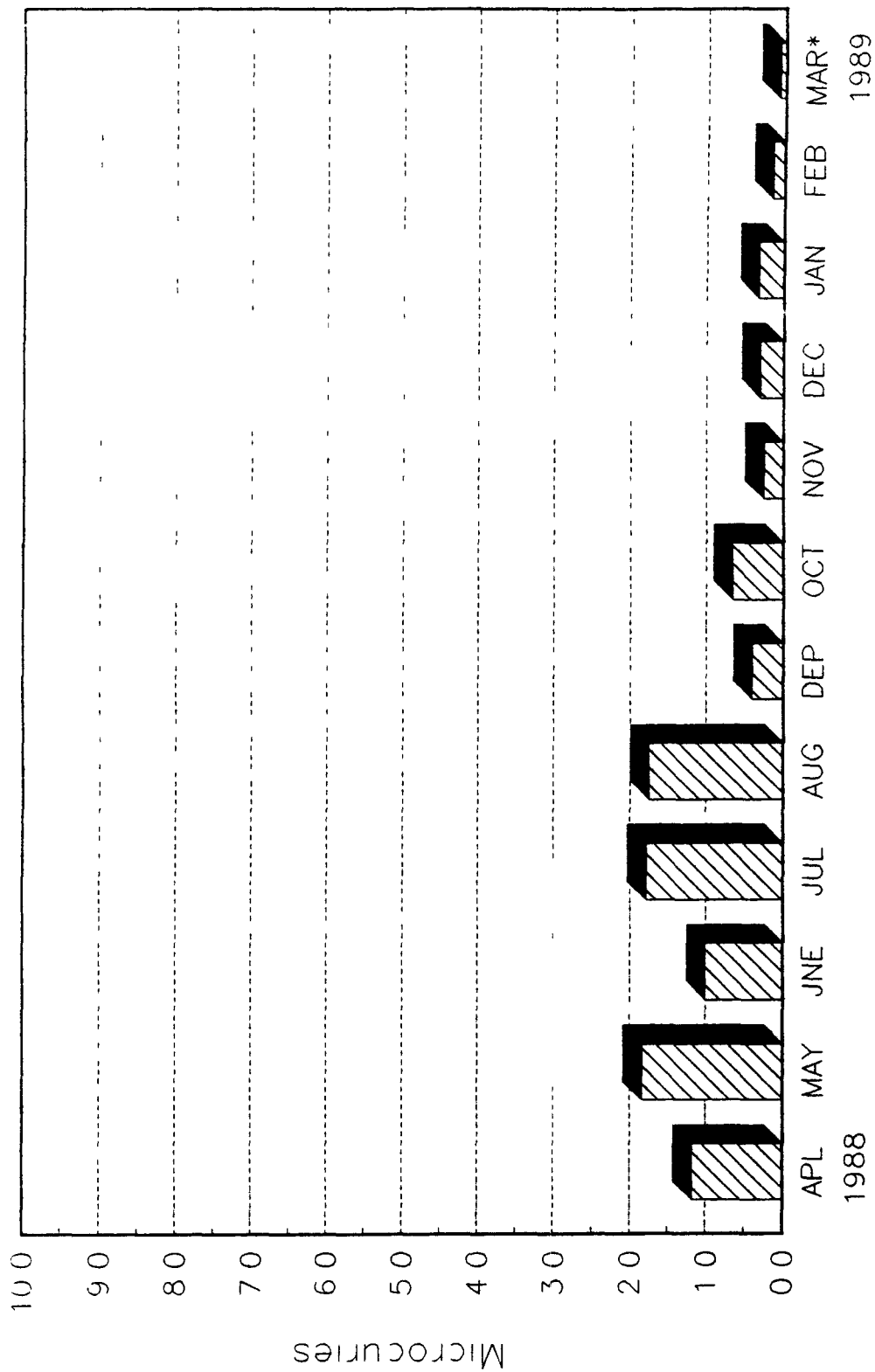
NOTE The plutonium, uranium, americium, and beryllium measured concentrations in this report include values that are less than the corresponding calculated minimum detectable concentrations (MDC's) In some cases, the values are less than zero. This method of reporting began in January 1981. These negative values result when the measured value for the laboratory reagent blank is subtracted from an analytical result which was measured as a smaller value than the reagent blank This may happen when measuring concentrations which are very close to zero

Table II 1989 Tritium and Beryllium Airborne Effluent Data

Month	Tritium		Beryllium	
	(01/20/89 - 02/20/89 - Feb)		(01/19/89 - 02/21/89 - Feb)	
	Release (Ci)	CMax (pCi/m3)	Release (grams)	CMax (ug/m3)
CY 1988	0 015	417 ± 250	0 1383	0 00041
January	0 001	97 ± 145	0 0285	0 00033
February	0 002	166 ± 120	-0 0392	-0 00005
March	0 007	389 ± 220	-0 0025	0 00000
April				
May				
June				
July				
August				
September				
October				
November				
December				
Year to Date	0 010	389 ± 220	-0.0132	0 00033

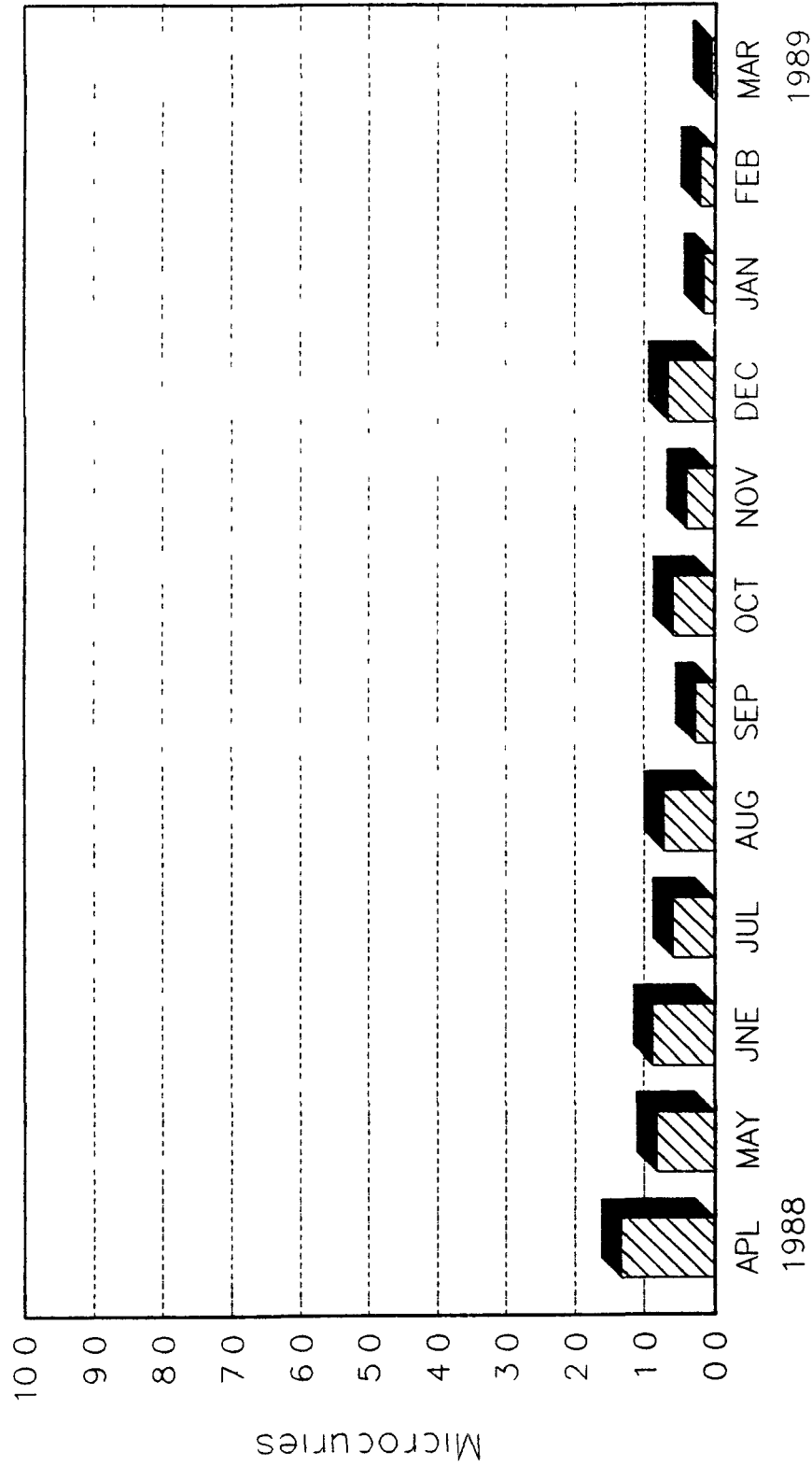
NOTE Beryllium measured at 36 other screening locations was below the screening level of 0.1 gram per month

PLUTONIUM MEASURED IN EFFLUENT AIR

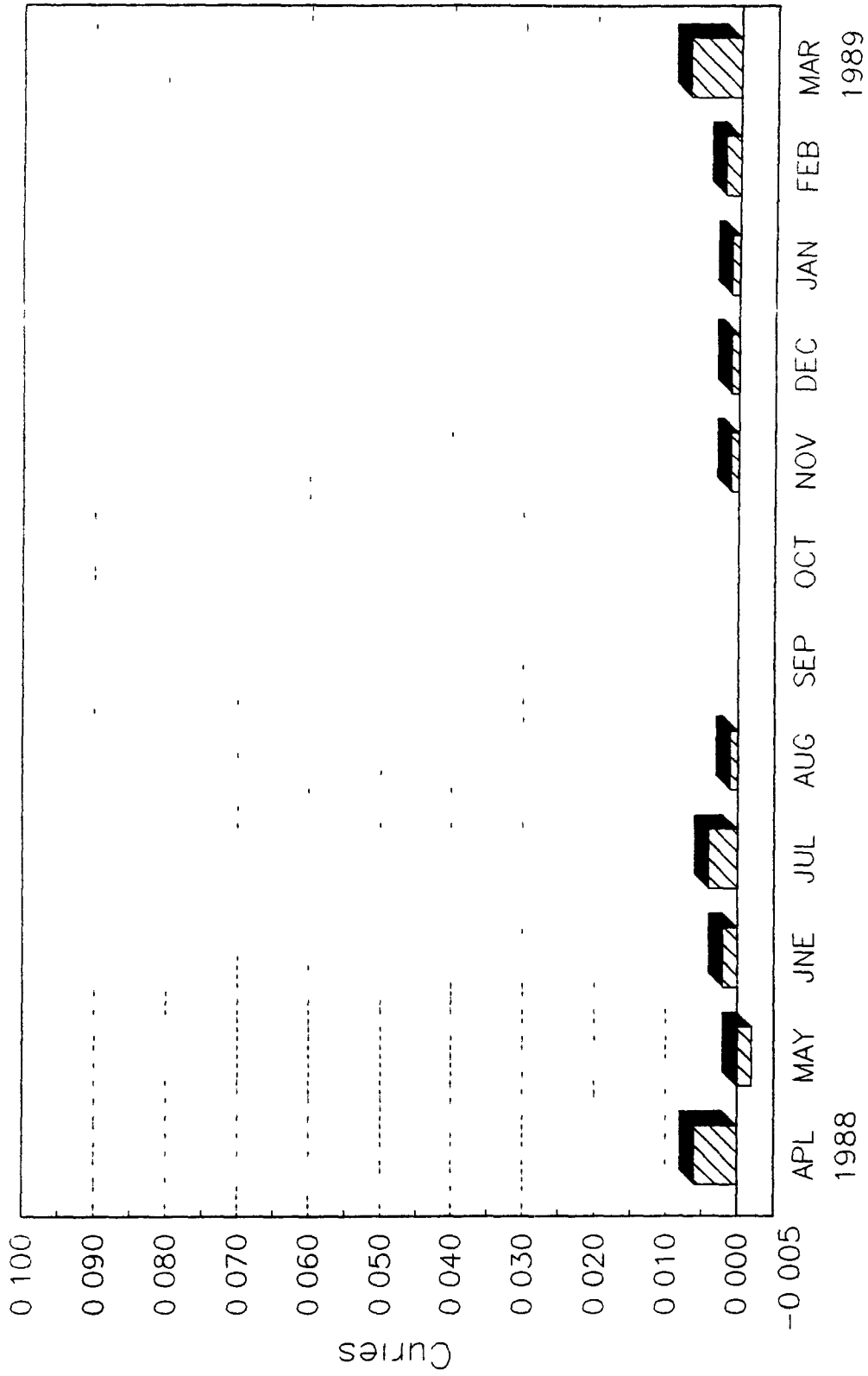


* Incomplete analysis,
Analysis in Progress
for 2 Samples

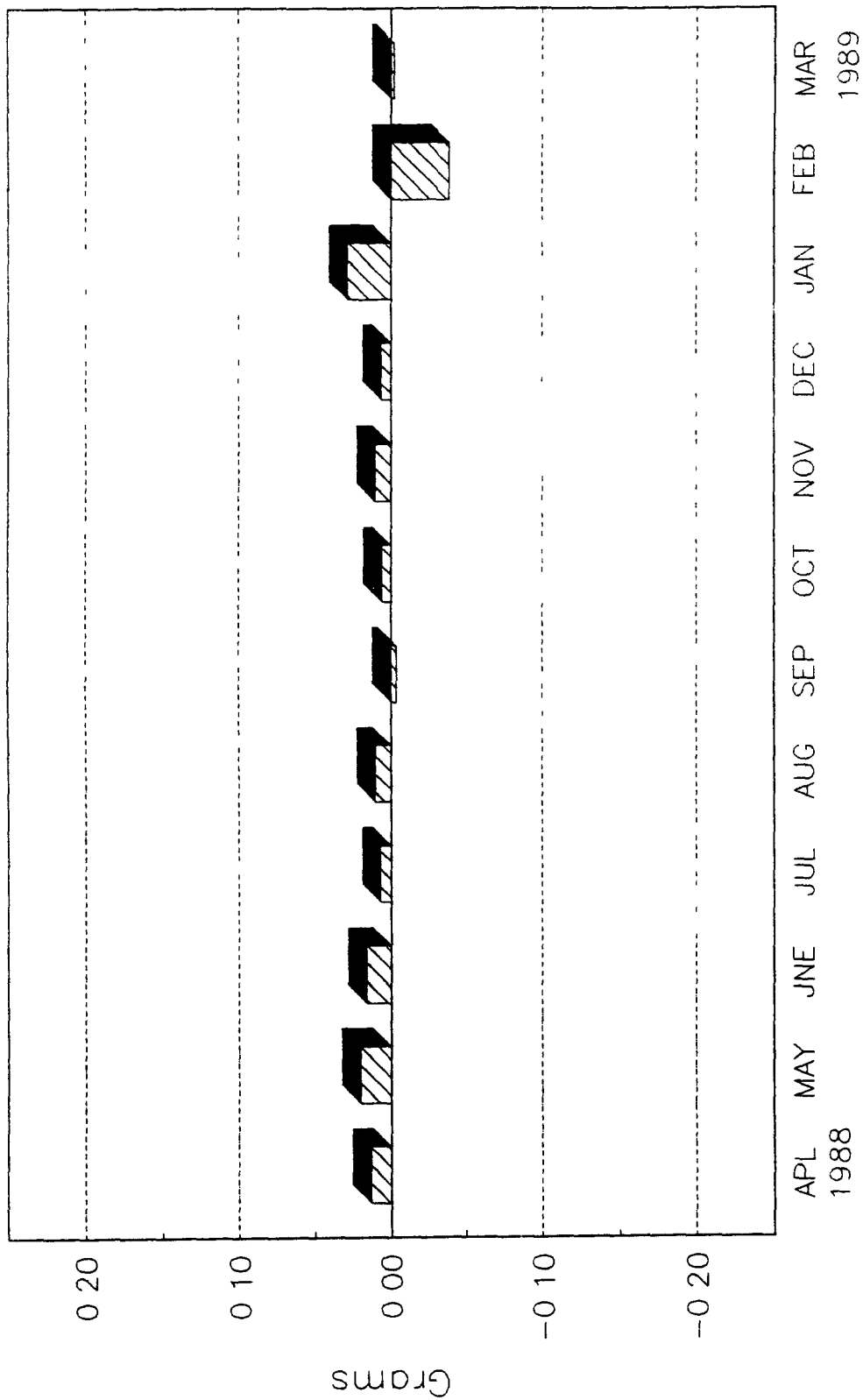
URANIUM MEASURED IN EFFLUENT AIR



TRITIUM MEASURED IN EFFLUENT WTP



BERYLLIUM MEASURED IN EFFLUENT AIR



MARCH 1989

Table III Plutonium at Selected Onsite Ambient Air Locations
(02/21/89 - 03/21/89)

<u>Concentration (pCi/m3)</u>				
<u>ation</u>	<u>n</u>	<u>Volume (m3)</u>	<u>Point Estimate</u>	<u>± Error</u>
05	2	28000	0 000117	0 000013
06	2	*	*	*
07	2	23000	0.000186	0.000023
08	2	32000	0.000336	0 000035
09	2	31000	0.000316	0.000033

ncomplete Analyses

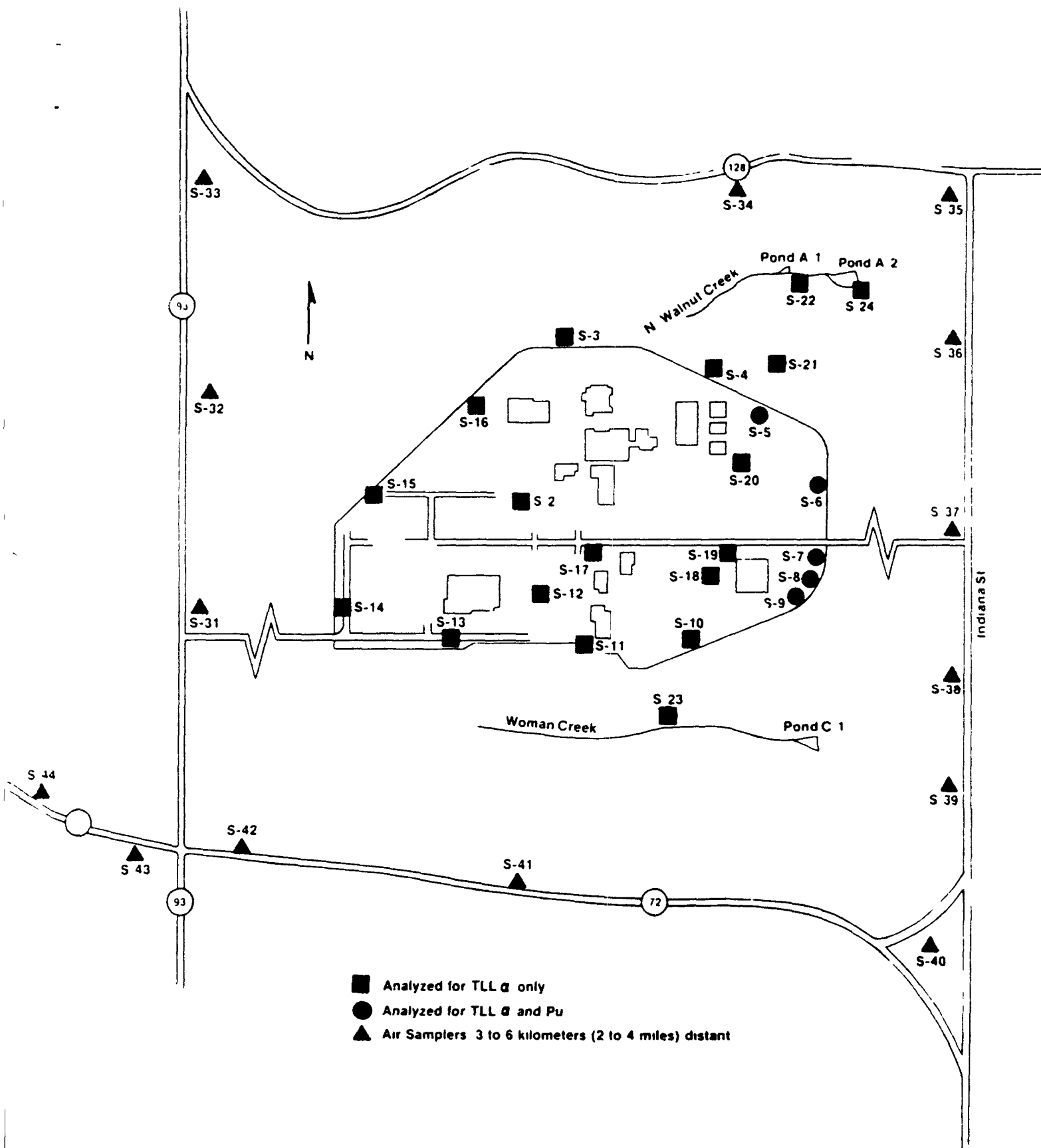
E Total long-lived alpha at the remaining 18 onsite ambient air samplers
was below the screening level of 0.01 pCi/m³

MARCH 1989

Table IV. Plutonium in Perimeter Ambient Air
(02/28/89 - 03/28/89)

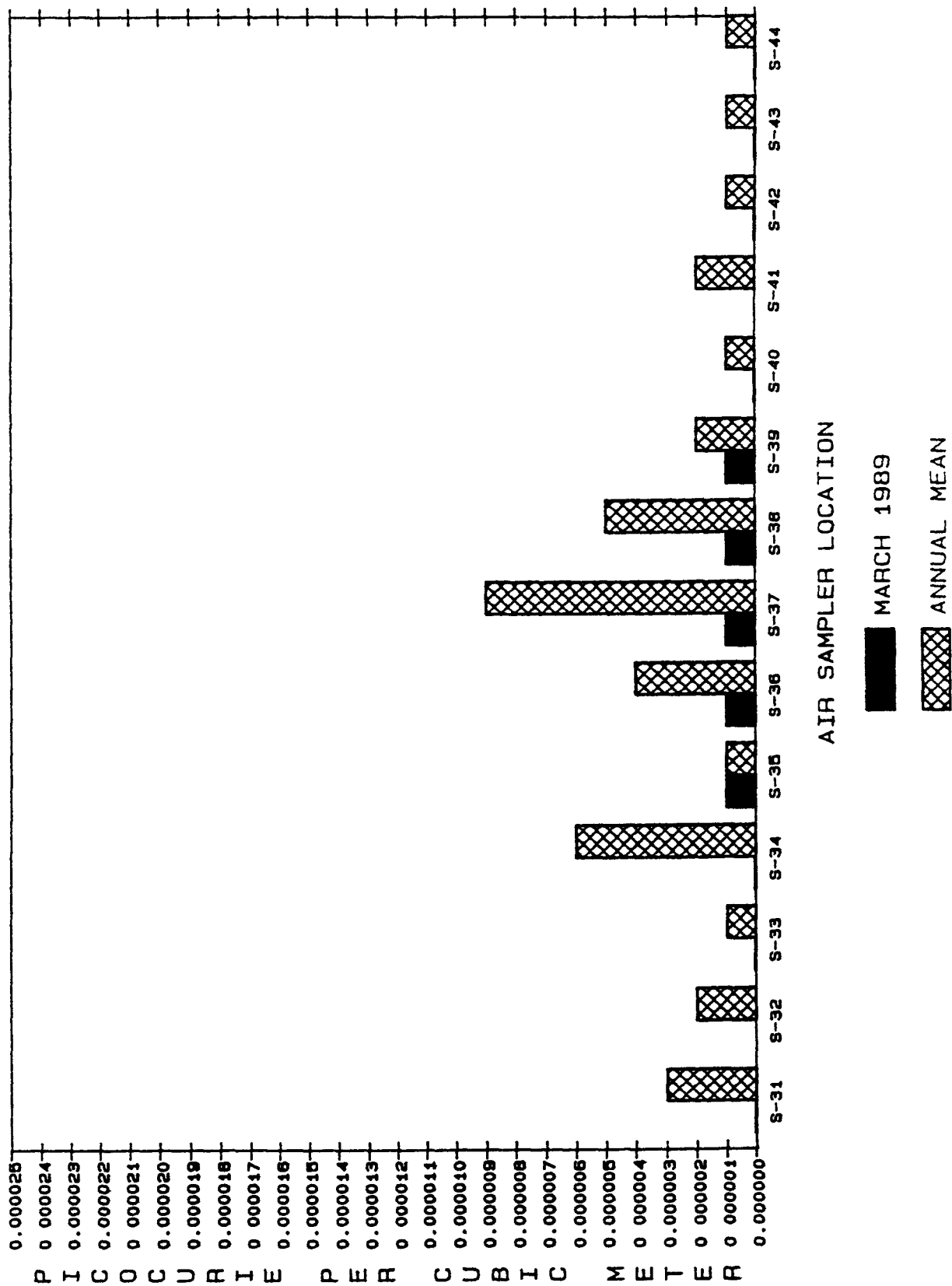
<u>Location</u>	<u>n</u>	<u>Volume (m3)</u>	<u>Concentration (pCi/m3)</u>	
			<u>Point Estimate</u>	<u>± Error</u>
S-31	1	19000	0 000000	0 000002
S-33	1	29000	0.000000	0 000001
S-34	1	30000	0 000000	0 000001
S-35	1	32000	0 000001	0 000001
S-36	1	30000	0 000001	0 000001
S-37	1	33000	0 000001	0 000001
S-38	1	28000	0 000001	0 000001
S-39	1	31000	0 000001	0 000001
S-40	1	30000	0 000000	0 000001
S-42	1	26000	0 000000	0 000001
S-43	1	31000	0 000000	0 000001
S-44	1	29000	0 000000	0 000001

Note Ambient air samplers S-32 and S-41 were inoperational during this period



Location of Onsite and Plant Perimeter Ambient Air Samplers
(Portions of figure are not to scale)

PLUTONIUM CONCENTRATIONS IN PERIMETER AMBIENT AIR

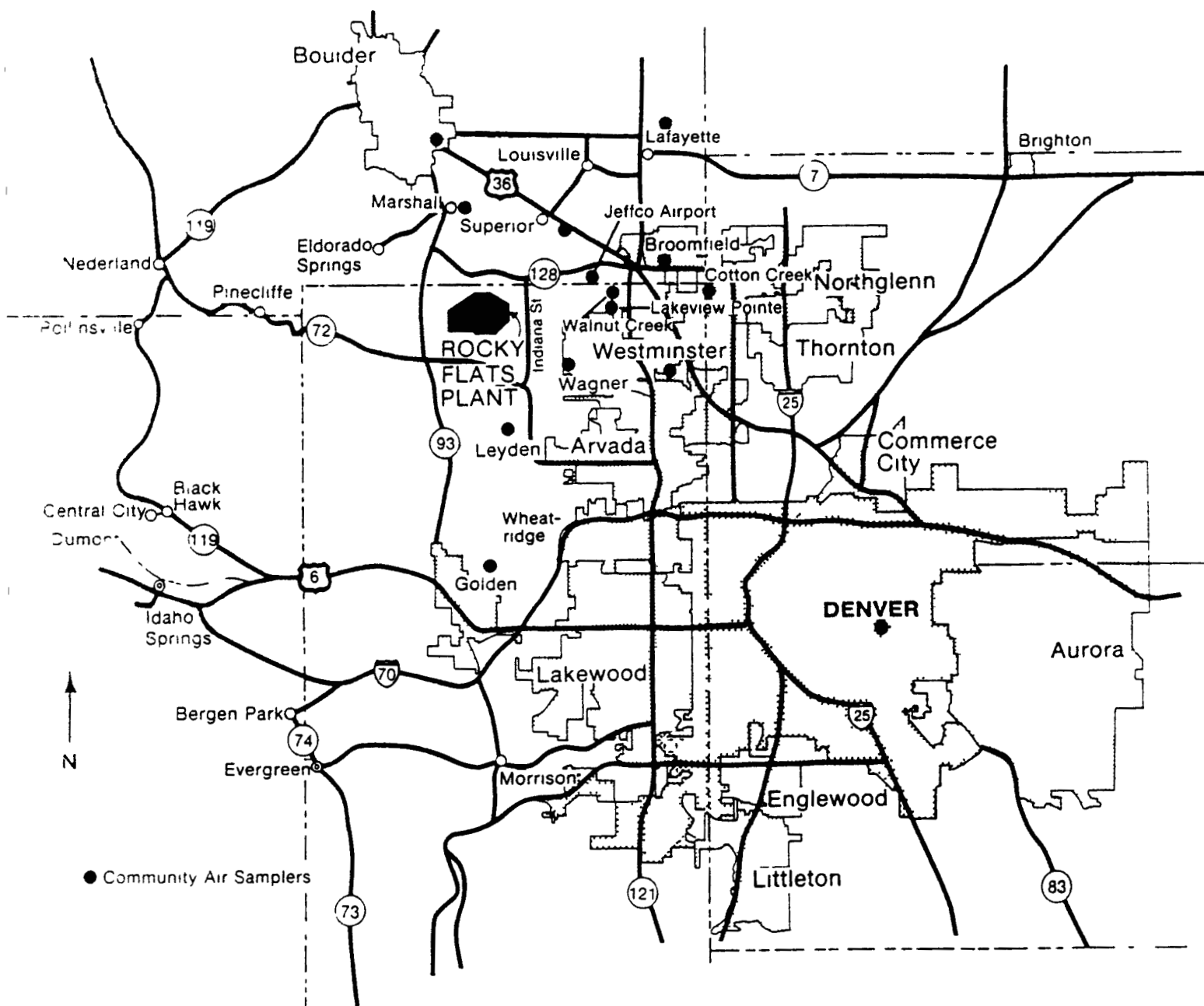


MARCH 1989

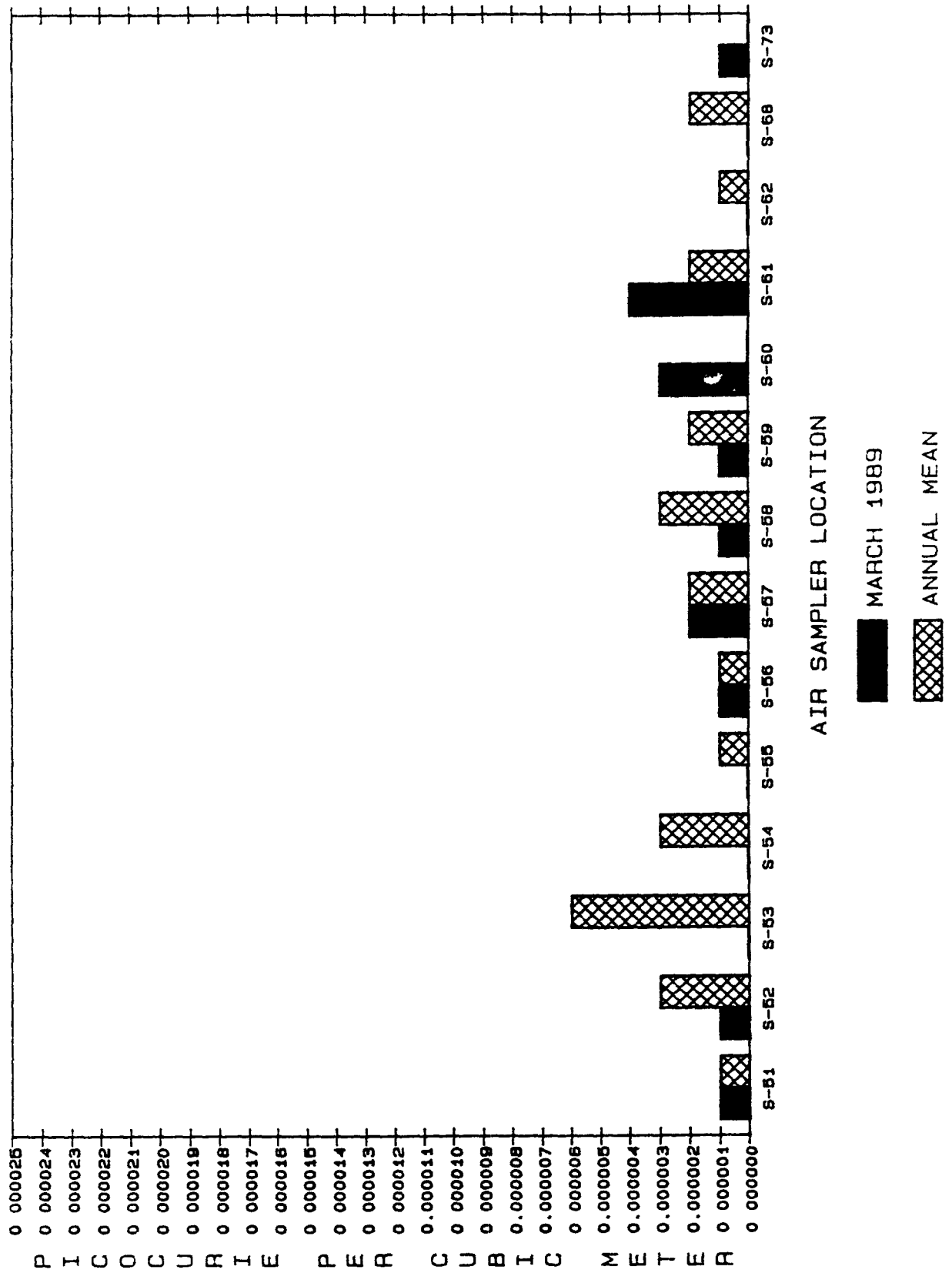
Table V Plutonium in Community Ambient Air
(03/01/89 - 03/29/89)

		<u>Concentration (pCi/m3)</u>			
<u>Location</u>	<u>Community Name</u>	<u>n</u>	<u>Volume (m3)</u>	<u>Point Estimate</u>	<u>± Error</u>
S-51	Marshall	1	27000	0 000001	0 000001
S-52	Jeffco Airport	1	34000	0 000001	0 000001
S-53	Superior	1	29000	0 000000	0 000001
S-54	Boulder	1	29000	0 000000	0 000001
S-55	Lafayette	1	29000	0 000000	0 000001
S-56	Broomfield	1	25000	0 000001	0 000001
S-57	Walnut Creek	1	30000	0 000002	0 000001
S-58	Wagner	1	29000	0 000001	0 000001
S-59	Leyden	1	32000	0 000001	0 000001
S-60	Westminster	1	21000	0 000003	0 000002
S-61	Denver	1	9000	0 000004	0 000004
S-62	Golden	1	37000	0 000000	0 000001
S-68	Lakeview Pointe	1	37000	0 000000	0 000001
S-73	Cotton Creek	1	27000	0 000001	0 000001

Location of Community Ambient Air Samplers



PLUTONIUM CONCENTRATIONS IN COMMUNITY AMBIENT AIR



MARCH 1989

Table VI Onsite Water Sample Results - Plutonium, Uranium, and Americium

Holding Pond Outfall (pCi/l)

<u>Location</u>	<u>Plutonium</u>	<u>Uranium</u>	<u>Americium</u>
-----------------	------------------	----------------	------------------

Pond A-4

No Discharge

Average Concentration

Pond B-5

No Discharge

Average Concentration

Pond C-1

03/06/89 - 03/10/89	-0 001 ± 0 005	0 29 ± 0 16	0 006 ± 0 006
03/13/89 - 03/17/89	0 001 ± 0 007	0 46 ± 0 16	0 005 ± 0 006
03/20/89 - 03/24/89	*	0 68 ± 0 17	-0 002 ± 0 008
03/27/89 - 03/31/89	0 035 ± 0 008	0 34 ± 0 165	*

Average Concentration

*

0 45 ± 0 17

*

Pond C-2

No Discharge

Average Concentration

Walnut Creek at Indiana

03/06/89 - 03/10/89	0 002 ± 0 009	4 92 ± 0 37	0 025 ± 0 011
03/13/89 - 03/17/89	0 004 ± 0 017	5 65 ± 0 34	0 003 ± 0 018

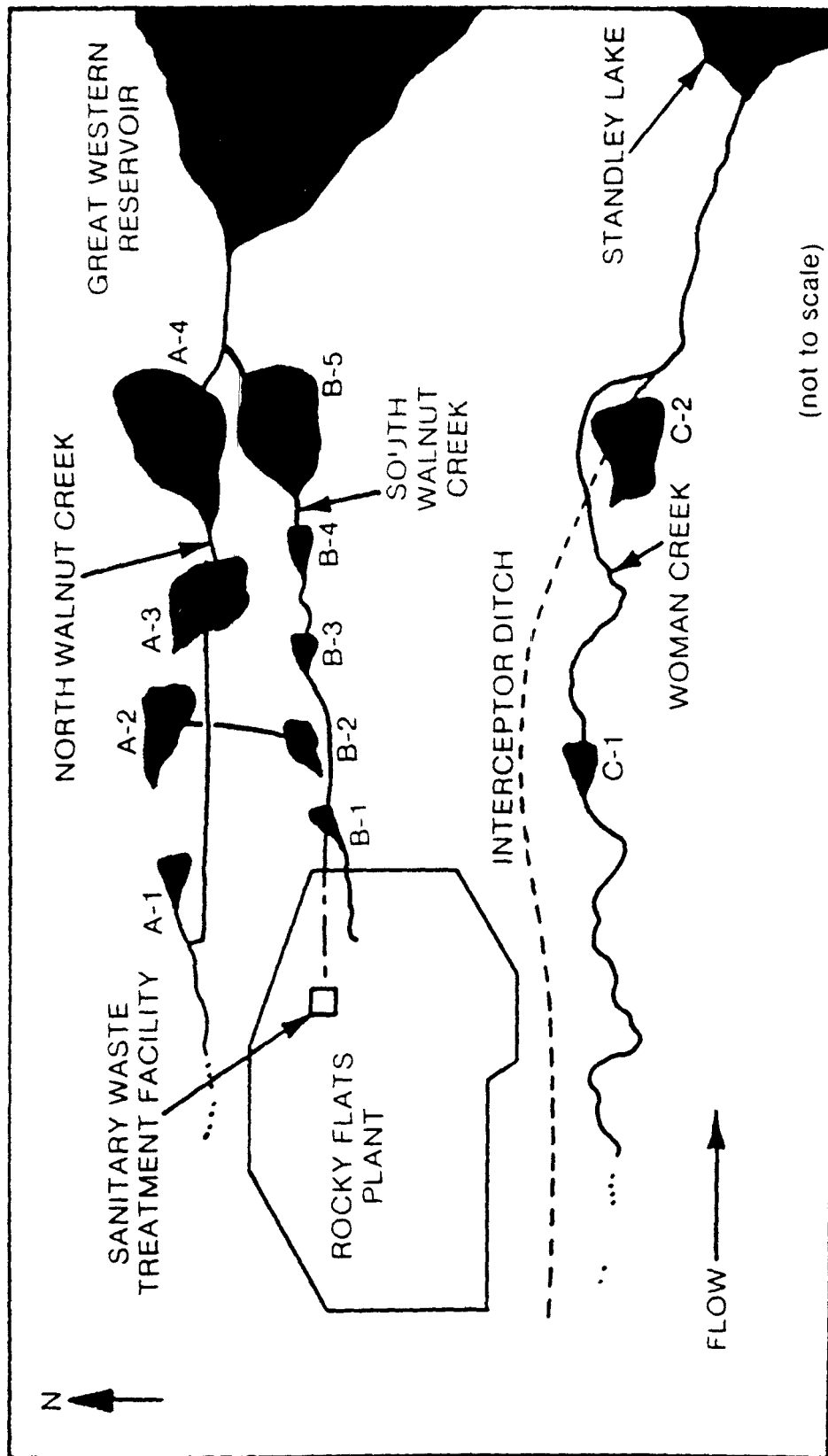
Average Concentration

0 003 ± 0.014

5 29 ± 0.35

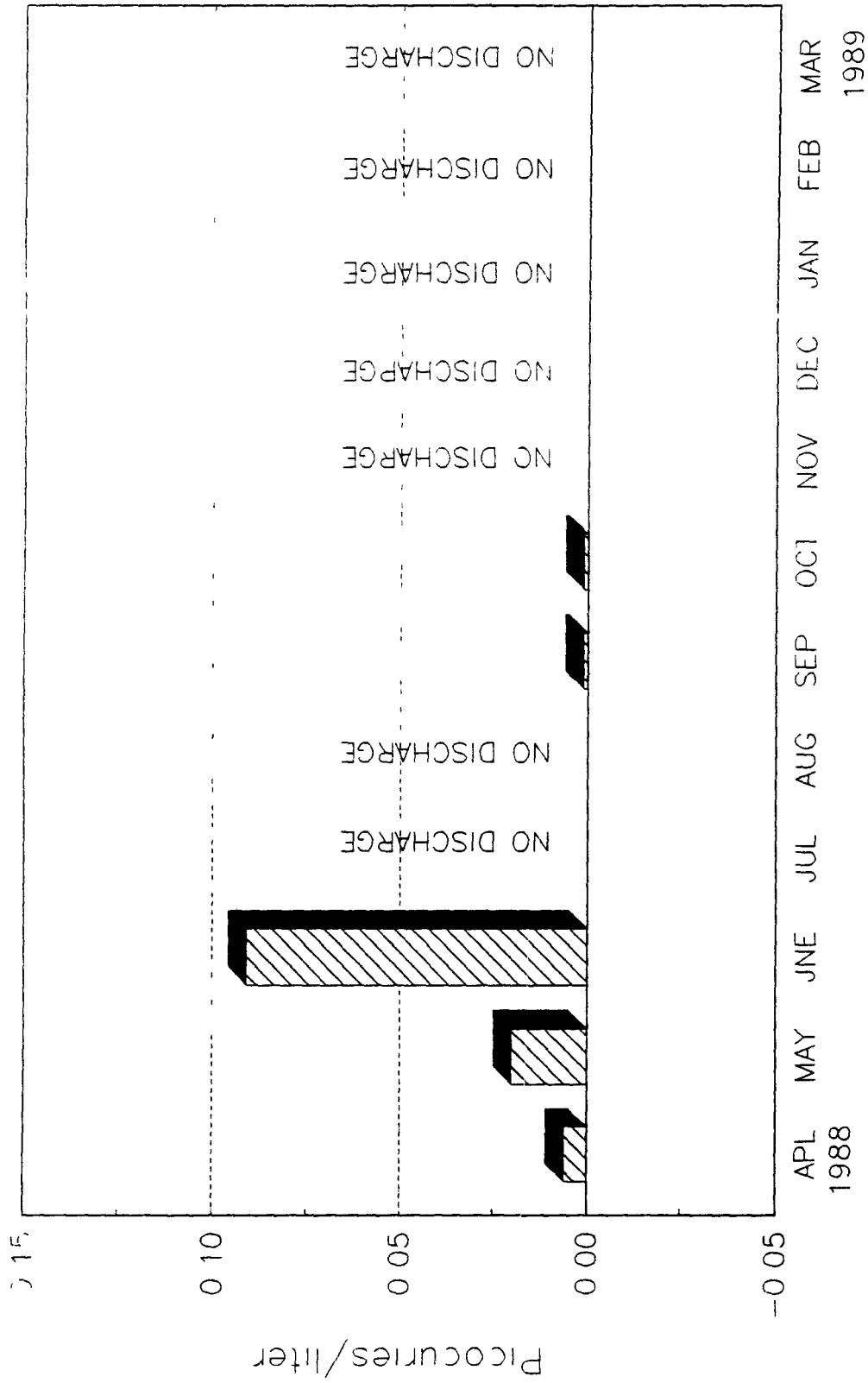
0.014 ± 0.014

* Analyses Incomplete

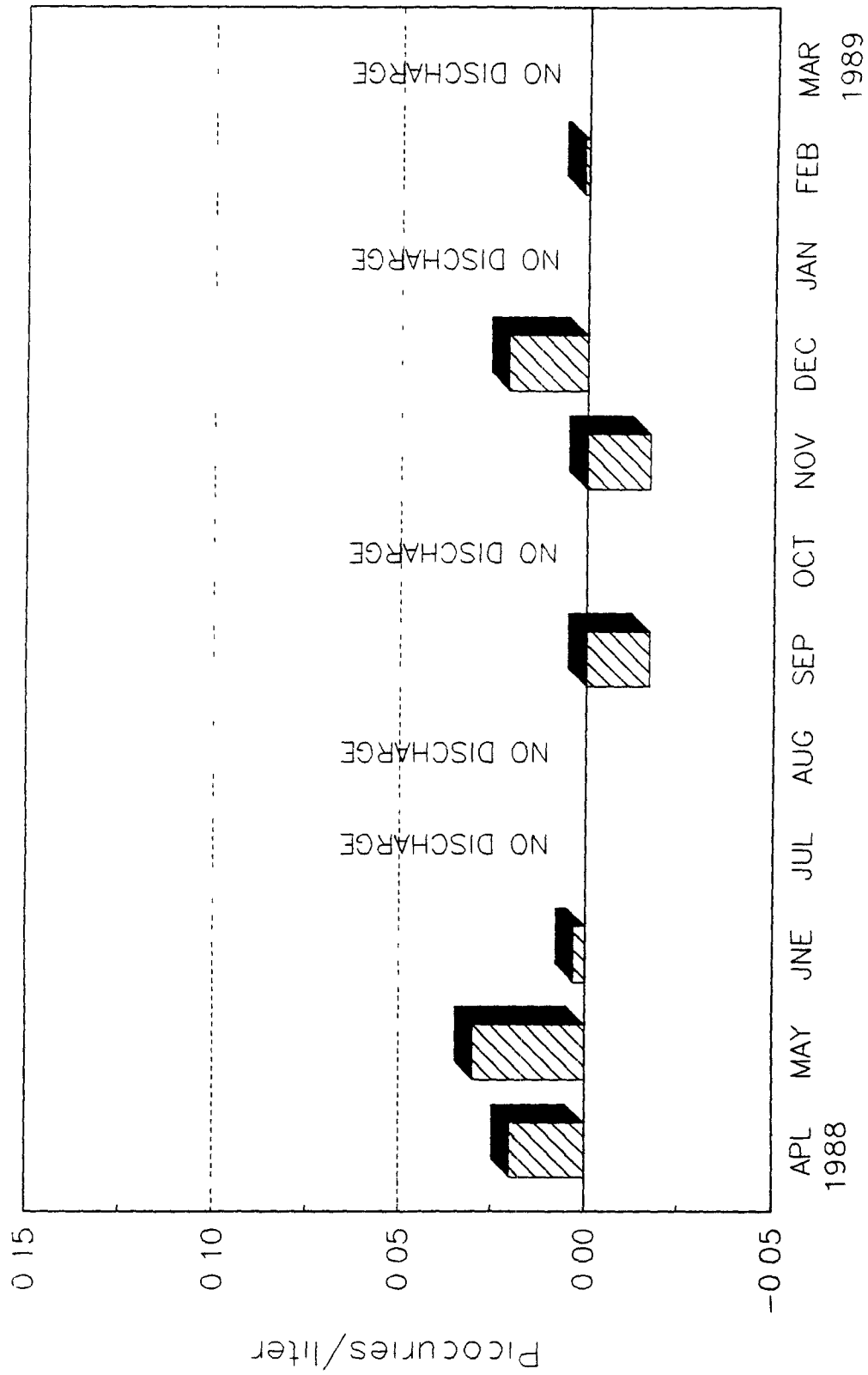


Holding Ponds and Liquid Effluent Watercourses

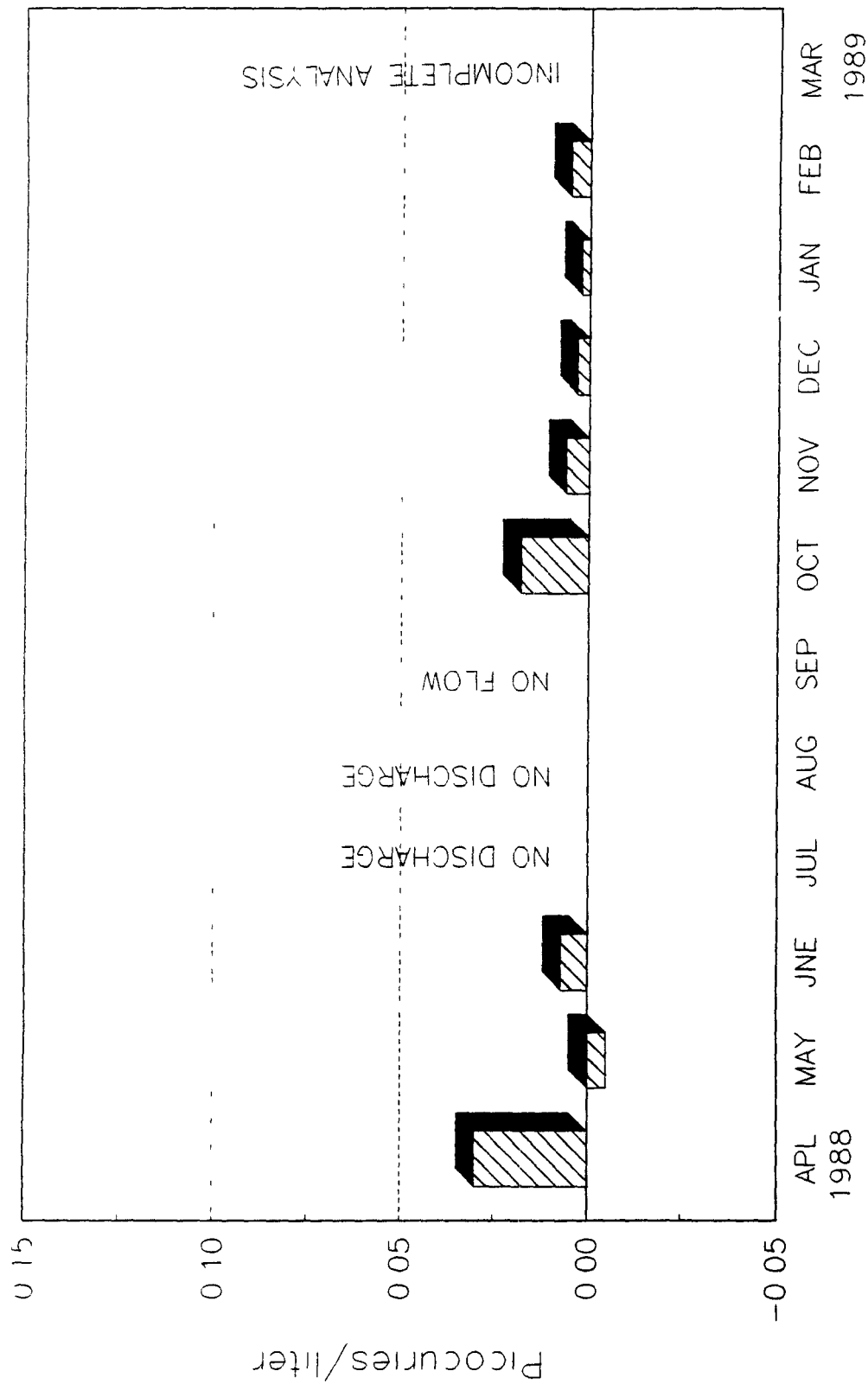
PLUTONIUM IN POND A-1 EFFLUENT WATER



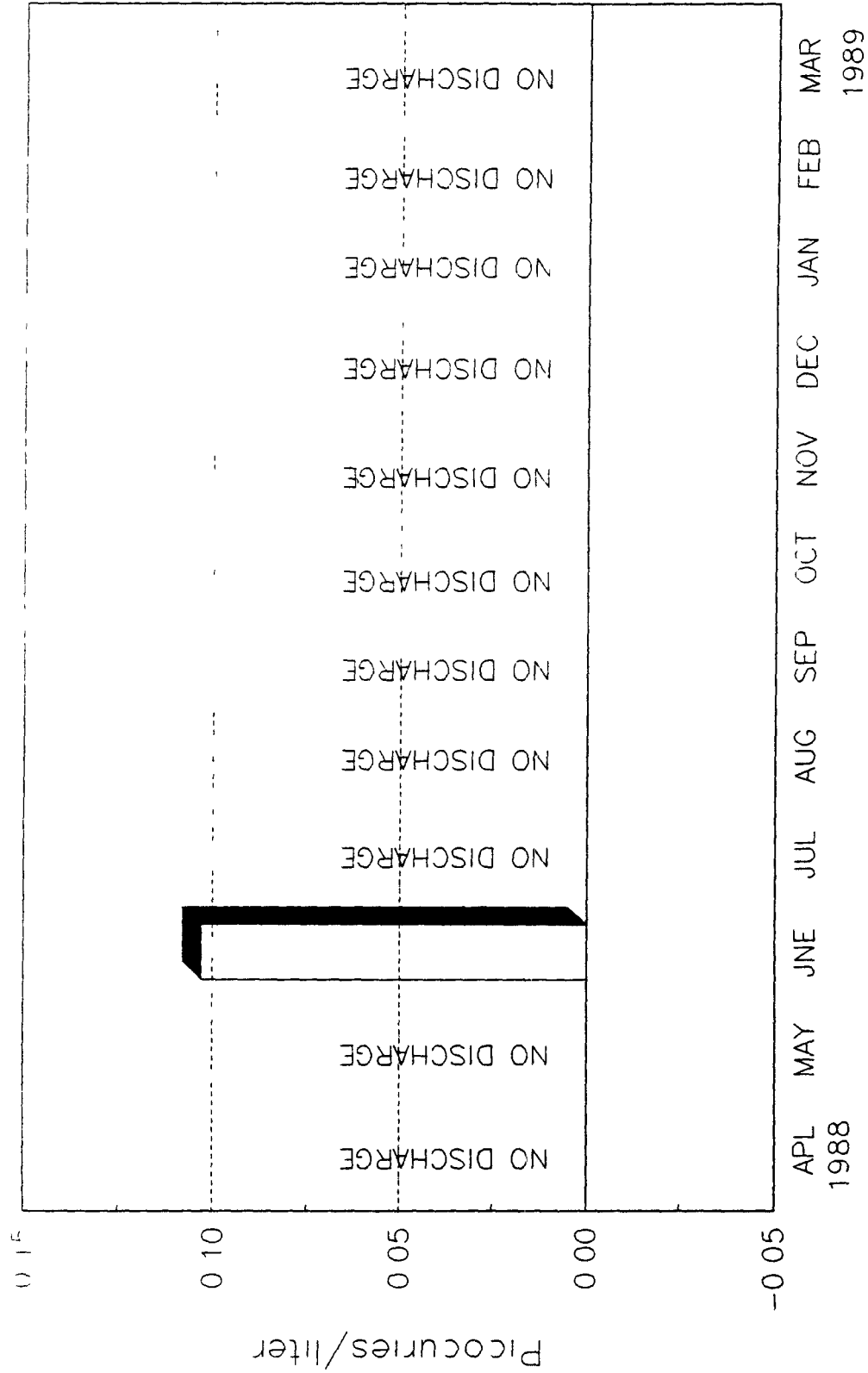
PLUTONIUM IN POND B-5 EFFLUENT WATER



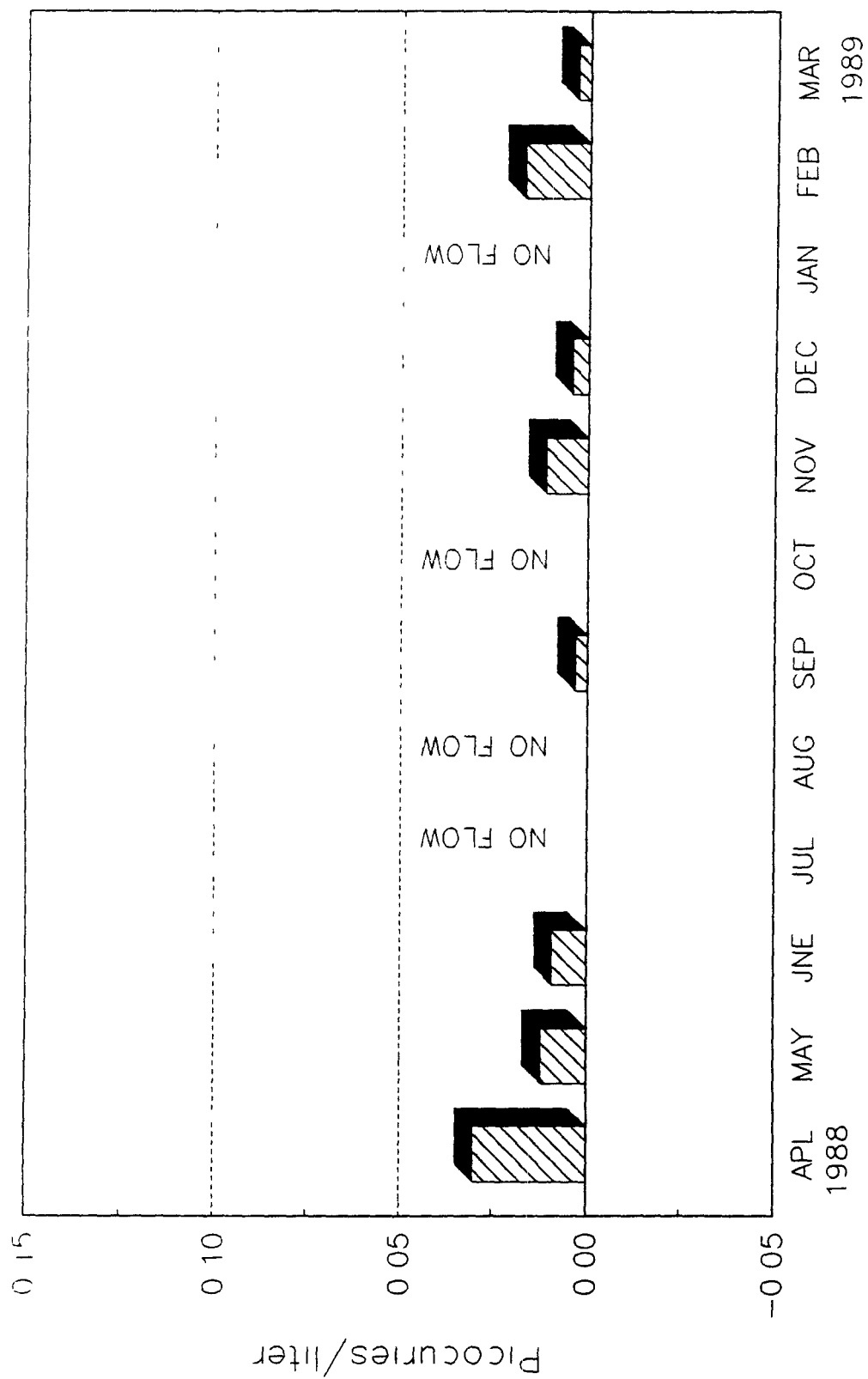
PLUTONIUM IN POND #1 EFFLUENT WATER



PLUTONIUM IN POND / EFFLUENT WATER



PLUTONIUM IN WALNUT CREEK AT INDIANA WATER



MARCH 1989

Table VII. Offsite Water Sample Results - Plutonium, Uranium, and Americium

Reservoirs (pCi/l)

<u>Location</u>	<u>n</u>	<u>Plutonium</u>	<u>Uranium</u>	<u>Americium</u>
Great Western	1*	**	1 66 ± 0.20	**
Standley Lake	1*	0.000 ± 0 007	1 66 ± 0 21	**

Community Tap Water (pCi/l)

<u>Location</u>	<u>n</u>	<u>Plutonium</u>	<u>Uranium</u>	<u>Americium</u>
Boulder	1*	-0 002 ± 0 007	0 55 ± 0 18	**
Broomfield	1*	**	1.36 ± 0 19	**
Westminster	1*	0 001 ± 0 007	0 61 ± 0 17	**

* Plutonium, uranium and americium analyses were performed on one sample composited from four weekly grab samples.

** Analyses Incomplete

MARCH 1989

Table VIII Onsite and Offsite Water Sample Results - Tritium

Tritium (pCi/l)

<u>Location</u>	<u>n</u>	<u>C_{Minimum}</u>	<u>C_{Maximum}</u>	<u>C_{Average}</u>
Pond A-4		No Discharge		
Pond B-5		No Discharge		
Pond C-1	3	-440 ± 316	51 ± 325	-188 ± 320
Pond C-2		No Discharge		
Walnut Creek at Indiana	5	-270 ± 288	88 ± 389	- 93 ± 318
Boulder	4	-109 ± 392	271 ± 329	96 ± 329
Broomfield	4	-150 ± 389	82 ± 324	- 15 ± 326
Great Western	4	- 31 ± 288	162 ± 330	62 ± 329
Standley	4	- 27 ± 393	243 ± 297	47 ± 329
Westminster	4	-104 ± 289	59 ± 327	- 20 ± 326

MARCH 1989

Table IX Offsite Water Sample Results - Nitrate as Nitrogen

Nitrate (as N) at Great Western Reservoir

<u>Sample Date</u>	<u>Nitrate (as N) (mg/l)</u>
03/02/89	<0 02
03/09/89	0 06
03/16/89	0 06
03/23/89	0 21
03/30/89	0 22

Nitrate (as N) at Standley Lake

<u>Sample Date</u>	<u>Nitrate (as N) (mg/l)</u>
03/02/89	0 22
03/09/89	0 24
03/16/89	0 06
03/23/89	0 07
03/30/89	0 05

NOTE For some nonradioactive parameters, the concentrations that are measured at or below the minimum detectable concentration (MDC) are assigned to MDC. The less than symbol (<) indicates MDC values and calculated values that include one or more MDC's

MARCH 1989

Table X NPDES Permit Water Sample Results

Discharge 001 (Pond B-3)

No Discharge

		<u>Measured</u>	<u>Limits</u>	<u>Measured</u>	<u>Limits</u>
		<u>30-Day</u>	<u>30-Day*</u>	<u>Daily</u>	<u>Daily</u>
		<u>Average</u>	<u>Average</u>	<u>Maximum</u>	<u>Maximum</u>
<u>Parameters</u>					
Biochem Oxygen Demand, 5 Day	mg/l	No Discharge	10	No Discharge	25
Total Suspended Solids	mg/l		30		NA
Nitrates as N	mg/l		10		NA
Total Chromium	mg/l		0.05		0.1
Total Phosphorus	mg/l		8		NA
Oil and Grease, Visual			NA		NA
Total Residual Chlorine	mg/l		NA		0.5
Fecal Coliforms	#/100 ml		200		NA

		<u>Measured</u>	<u>Limits</u>	<u>Measured</u>	<u>Limits</u>
		<u>Daily</u>	<u>Daily</u>	<u>Daily</u>	<u>Daily</u>
		<u>Minimum</u>	<u>Minimum</u>	<u>Maximum</u>	<u>Maximum</u>
<u>Parameter</u>					
pH	S U	No Discharge	6.0	No Discharge	9.0

Discharge 002 (Pond A-3)

No Discharge

		<u>Measured</u>	<u>Limits</u>	<u>Measured</u>	<u>Limits</u>
		<u>30-Day</u>	<u>30-Day*</u>	<u>Daily</u>	<u>Daily</u>
		<u>Average</u>	<u>Average</u>	<u>Maximum</u>	<u>Maximum</u>
<u>Parameters</u>					
Nitrates as N	mg/l	No Discharge	10	No Discharge	20
		<u>Measured</u>	<u>Limits</u>	<u>Measured</u>	<u>Limits</u>
		<u>Daily</u>	<u>Daily</u>	<u>Daily</u>	<u>Daily</u>
		<u>Minimum</u>	<u>Minimum</u>	<u>Maximum</u>	<u>Maximum</u>
pH	S U	No Discharge	6.0	No Discharge	9.0

Discharge 003 (RO Pilot Plant)

No Discharge

		<u>Measured</u>	<u>Limits</u>	<u>Measured</u>	<u>Limits</u>
		<u>Daily</u>	<u>Daily</u>	<u>Daily</u>	<u>Daily</u>
		<u>Minimum</u>	<u>Minimum</u>	<u>Maximum</u>	<u>Maximum</u>
<u>Parameter</u>					
pH	S.U	No Discharge	6.0	No Discharge	9.0

* This limitation applies when a minimum of 3 consecutive samples are taken during separate weeks

MARCH 1989

Table X NPDES Permit Water Sample Results (Continued)

Discharge 004 (RO Plant)

No Discharge

<u>Parameters</u>			<u>Measured</u>	<u>Limits</u>	<u>Measured</u>	<u>Limits</u>
			30-Day Average	30-Day* Average	Daily Maximum	Daily Maximum
Total Suspended Solids	mg/l		No Discharge	15	No Discharge	25
Total Organic Compounds	mg/l			22		30
Total Phosphorus	mg/l			8		12
Nitrates as N	mg/l			10		20
Total Chromium	mg/l			0 05		0 1
Total Residual Chlorine	mg/l			NA		0 5
			<u>7-Day Average</u>	<u>7-Day Average</u>	<u>30-Day Average</u>	<u>30-Day Average</u>
Fecal Coliform	#/100 ml		No Discharge	400	No Discharge	200
			<u>Daily Minimum</u>	<u>Daily Minimum</u>	<u>Daily Maximum</u>	<u>Daily Maximum</u>
pH	S U		No Discharge	6 0	No Discharge	9 0

Discharge 005 (Pond A-4)

No Discharge

<u>Parameters</u>		<u>n</u>	<u>C_{Minimum}</u>	<u>C_{Maximum}</u>	<u>C_{Average}</u>
pH	S U		No Discharge		
Nitrates as N	mg/l				
Nonvolatile Suspended Solids	mg/l				

Discharge 006 (Pond B-5)

No Discharge

<u>Parameters</u>		<u>n</u>	<u>C_{Minimum}</u>	<u>C_{Maximum}</u>	<u>C_{Average}</u>
pH	S U		No Discharge		
Nitrates as N	mg/l				
Nonvolatile Suspended Solids	mg/l				

Discharge 007 (Pond C-2)

No Discharge

<u>Parameters</u>		<u>n</u>	<u>C_{Minimum}</u>	<u>C_{Maximum}</u>	<u>C_{Average}</u>
pH	S U		No Discharge		
Nitrates as N	mg/l				
Nonvolatile Suspended Solids	mg/l				

MARCH 1989

Table XI Water Sample Results, Nonradioactive Parameters

Walnut Creek at Indiana Street

<u>Parameters</u>		<u>n</u>	<u>C_{Minimum}</u>	<u>C_{Maximum}</u>	<u>C_{Average}</u>
pH	S U	3	6 5	6 8	N/A
Nitrates as N	mg/l	3	0 20	0 80	0 46

Total Volume (gallons) = 799,000

Table XII.
Daily Flow Data Recorded at the
Walnut Creek at Indiana Gaging Station
Ponds A-4 and B-5,
March, 1989

(Walnut Creek Drainage)

<u>DATE</u>	<u>WALNUT CREEK AT INDIANA (gallons)</u>	<u>POND A-4 (gallons)</u>	<u>POND B-5 (gallons)</u>
03/01/89	No Flow	No Discharge	No Discharge
03/02/89	" "	" "	" "
03/03/89	" "	" "	" "
03/06/89	" "	" "	" "
03/07/89	" "	" "	" "
03/08/89	262,000	" "	" "
03/09/89	306,000	" "	" "
03/10/89	182,000	" "	" "
03/13/89	26,000	" "	" "
03/14/89	23,000	" "	" "
03/15/89	No Flow	" "	" "
03/16/89	" "	" "	" "
03/17/89	" "	" "	" "
03/20/89	" "	" "	" "
03/21/89	" "	" "	" "
03/22/89	" "	" "	" "
03/23/89	" "	" "	" "
03/27/89	" "	" "	" "
03/28/89	" "	" "	" "
03/29/89	" "	" "	" "
03/30/89	" "	" "	" "
03/31/89	" "	" "	" "

TOTAL VOLUME	799,000*	No Discharge	No Discharge
--------------	----------	--------------	--------------

* Precipitation/Runoff

Table XIII
Daily Flow Data Recorded at
Ponds C-1 and C-2 During
March, 1989

(Woman Creek Drainage)

<u>DATE</u>	<u>POND C-1 (gallons)</u>	<u>POND C-2 (gallons)</u>
03/01/89	628,000	No Discharge
03/02/89	512,000	" "
03/03/89	572,000	" "
03/06/89	1,282,000	" "
03/07/89	384,000	" "
03/08/89	556,000	" "
03/09/89	512,000	" "
03/10/89	600,000	" "
03/13/89	1,814,000	" "
03/14/89	642,000	" "
03/15/89	556,000	" "
03/16/89	556,000	" "
03/17/89	532,000	" "
03/20/89	1,440,000	" "
03/21/89	536,000	" "
03/22/89	552,000	" "
03/23/89	460,000	" "
03/27/89	2,202,000	" "
03/28/89	458,000	" "
03/29/89	532,000	" "
03/30/89	484,000	" "
03/31/89	526,000	" "
 TOTAL VOLUME	 16,336,000	 No Discharge

Appendix

RADIATION STANDARDS FOR PROTECTION OF THE PUBLIC

Introduction

The primary standards for protection of the public from radiation are based on radiation dose. Radiation dose is a means of quantifying the biological damage or risk of ionizing radiation. The unit of radiation dose is the rem or the millirem (1 rem = 1,000 mrem). Radiation protection standards for the public are annual standards, based on the projected radiation dose from a year's exposure to or intake of radioactive materials.

Radiation dose is a calculated value. It is calculated by multiplying radioactivity concentrations in air and water or on contaminated surfaces by assumed intake rates (for internal exposures) or exposure times (for external exposure to penetrating radiation), then by the appropriate radiation dose conversion factors. That is:

$$\begin{aligned} \text{RADIATION DOSE} = & \\ (\text{RADIOACTIVITY CONCENTRATION}) \times & \\ (\text{INTAKE RATE/EXPOSURE TIME}) \times & \\ (\text{DOSE CONVERSION FACTOR}) & \end{aligned}$$

The radioactivity concentrations can be determined either by measurements in the environment or by calculations using computer models. These computer models perform airborne dispersion/dose modeling of measured

building radioactivity effluents and estimated diffuse source term emissions (e.g., from resuspension from contaminated soil areas).

The assumed intake rates and dose conversion factors used are based on recommendations of national and international radiation protection advisory organizations, such as the National Council of Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP).

The radioactive materials of importance in calculating radiation dose to the public from Rocky Flats Plant activities include plutonium, uranium, americium, and tritium. The alpha radiation emissions from the plutonium, uranium, and americium are the primary contributors to the projected radiation dose.

Potential public radiation dose commitments, which could have resulted from Plant operations and from background (i.e., non-Plant) contributions, are calculated from average radionuclide concentrations measured at the Department of Energy (DOE) property boundary and in surrounding communities. Inhalation and water ingestion are the principal potential pathways of human exposure.

Calculation of Potential Plant Contribution to Public Radiation Dose

Pending final revision of its DOE Order for radiation protection standards for the public, DOE adopted an interim radiation protection standard for DOE environmental activities to be implemented in CY1985 (Va85). This interim standard incorporates guidance from the National Council on Radiation Protection and Measurements (NCRP), as well as the Environmental Protection Agency Clean Air Act air emission standards (as implemented in 40 CFR 61, Subpart H). Included in the interim standard is a revision of the dose

limits for members of the public. Tables of radiation dose conversion factors currently used for calculating dose from intakes of radioactive materials were issued in July 1988 (US88a, US88b). The dose factors are based on the International Commission on Radiological Protection (ICRP) Publications 30 and 48 methodology and biological models for radiation dosimetry. The DOE interim standard and the dose conversion factor tables are used for assessment of any potential Rocky Flats Plant contribution to public radiation dose. The DOE radiation standards for protection of the public are given below.

DOE RADIATION PROTECTION STANDARDS FOR THE PUBLIC

ICRP-, NCRP- RECOMMENDED STANDARDS FOR ALL PATHWAYS

OCCASIONAL EXPOSURES -	500 mrem/year EFFECTIVE DOSE EQUIVALENT*
PROLONGED EXPOSURES - (>5 YEARS)	100 mrem/year EFFECTIVE DOSE EQUIVALENT
INDIVIDUAL ORGAN -	5,000 mrem/year DOSE EQUIVALENT

EPA CLEAN AIR ACT STANDARDS FOR THE AIR PATHWAY ONLY

WHOLE BODY -	25 mrem/year DOSE EQUIVALENT
ANY ORGAN -	75 mrem/year DOSE EQUIVALENT

Secondary radioactivity concentration guides can be calculated from the primary radiation dose standards and used as comparison values for measured radioactivity concentrations. DOE provided guidance for calculating these concentration guides - called "Derived Concentration Guides" - in a 1985 memorandum to its facilities (St85). Derived Concentration Guides (DCGs) are the concentrations which would result in an effective dose equivalent of 100 mrem from one year's chronic exposure or intake. In calculating air inhalation DCGs, DOE assumes that the exposed individual inhales 8,400 cubic meters of air at the calculated DCG during the year. Ingestion DCGs assume a water intake of 730 liters at the calculated DCG for the year. The following table lists the air and water DCGs for the principal radionuclides of interest at the Rocky Flats Plant.

To determine compliance with the EPA air emissions standards, measured airborne effluent radioactivity emissions and estimated radioactivity resuspension from soil are entered into the EPA-approved atmospheric dispersion/dose calculation computer model, AIRDOS-EPA, for calculation of the maximum radiation dose that an individual in the public could receive from the air pathway only.

For comparison with the annual radiation dose standards for protection of the public, the maximum annual effective dose equivalent that a member of the public could receive as a result of Rocky Flats Plant activities is typically less than 1 mrem, or less than 1 percent of the recommended annual standard for all pathways.

DOE DERIVED CONCENTRATION GUIDES FOR RADIONUCLIDES OF INTEREST AT THE ROCKY FLATS PLANT

AIR INHALATION:

<u>Radionuclide</u>	<u>DCG (pCi/m³)</u>
Pu-239, -240	0.02

WATER INGESTION:

<u>Radionuclide</u>	<u>DCG (pCi/l)</u>
Pu-239, -240	30
Am-241	30
U-233, -234, -238	500
H-3	2,000,000

References

- US88a DOE/EH-0070, "External Dose-Rate Conversion Factors for Calculation of Dose to the Public," U S Dept of Energy, Asst Secretary for Environment, Safety and Health, Office of Environmental Guidance and Compliance, July 1988
- US88b DOE/EH-0071, "Internal Dose Conversion Factors for Calculation of Dose to the Public," U S Dept of Energy, Asst Secretary for Environment, Safety and Health, July 1988
- Va85 Vaughan, W A , Asst Secretary, "Radiation Standards for Protection of the Public in the Vicinity of DOE Facilities," DOE memorandum from Environment, Safety and Health, August 5, 1985
- St86 Stern, R J , Director, "Preparation of Annual Site Environmental Reports for Calendar Year 1985," DOE memorandum, Office of Environmental Guidance, February 28, 1986

***NOTE:** "Dose equivalent" is a calculated value used to quantify radiation dose, it reflects the degree of biological effect from ionizing radiation. Differences in the biological effect of different types of ionizing radiation (e g , alpha, beta, gamma, or x-rays) are accounted for in the calculation of dose equivalent.

"Effective dose equivalent" is a calculated value used to allow comparisons of total health risk (based primarily on the risk of cancer

mortality) from exposures of different types of ionizing radiation to different body organs. It is calculated by first calculating the dose equivalent to those organs receiving significant exposures, multiplying each organ dose equivalent by a health risk weighting factor, and then summing those products. One millirem effective dose equivalent from natural background radiation would have the same health risk as one millirem effective dose equivalent from artificially-produced sources of radiation.